

BMP #128 - Retaining Walls

DESCRIPTION

Walls constructed against a slope or stream bank to prevent slope erosion or slope failure, or undercutting of the bank. Examples of retaining wall materials include: concrete, concrete masonry, rock, wood planking or railroad ties, and metal bins. Also see BMP #129- Gabions.

APPLICATIONS

For slope protection or stabilization under extreme conditions or to protect erodible, unstable stream banks.

Concrete retaining wall: An engineered concrete wall which is designed to stabilize a slope and retain the rock or soil behind it. In addition to a solid concrete wall, precast, interlocking concrete blocks could be used.

Masonry retaining wall: An engineered structure similar to a concrete retaining wall but using masonry blocks, usually of specific design for aesthetic appeal.

Native rock retaining wall: A low-gravity wall constructed of rock materials native to the construction site. It provides an aesthetically attractive method of stabilizing a slope. Native rock is suitable for walls up to about 6.5 feet (2 meters) in vertical height where the slope is steeper than 2:1 behind the wall. They can be higher on slopes of 2:1 (or flatter) gradient with proper engineering design.

Redwood (wood planking) retaining wall: A retaining wall constructed of redwood planking and posts. Redwood retaining walls are useful for relatively small slopes of loose material which are underlain by a rigid rock base material or a firm, non-plastic subsoil with high shear strength. The firm foundation is necessary to securely anchor the wall. Can construct in poorer foundation soils by using longer posts and closer spacing, 3 feet (1.0 meter) maximum. Redwood will generally last longer than other woods.

Railroad tie retaining wall: A retaining wall constructed of railroad ties. These are useful for relatively small slopes of loose material which are underlain by a rigid base of rock or a firm, non-plastic subsoil. The wall must be securely anchored to the rock base or firm subsoil.

Mechanically stabilized earth (MSE) retaining walls: The following are considered MSE walls: reinforced earth, retained earth, Hilfiker, Genesis (Keystone/Tensar), and T-wall. All of those designs use some type of anchored structure to retain earthen materials behind a wall.

LIMITATIONS

Targeted Pollutants

- ☒ Sediment
- ☐ Phosphorus
- ☐ Trace metals
- ☐ Bacteria
- ☐ Petroleum hydrocarbons

Physical Limits

Drainage area	<u>unlimited</u>
Max slope	<u>67 %</u>
Min bedrock depth	<u>N/A</u>
Min water table	<u>3</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>fair</u>
Drainage/Flood control	<u>no</u>

Retaining walls should be considered a permanent measure only. Cost and site-specific design requirements limit their use to situations where other stabilization measures would be ineffective or aesthetically unacceptable.

- Native rock retaining walls have a maximum height of about 6.5 feet (2 meters).
- Redwood retaining walls require a firm foundation to anchor the wall.
- Wood treated with creosote or other chemicals to retard decay may leach out and cause toxic effects. Treated railroad ties should not be used along sensitive streams for instance.

DESIGN PARAMETERS

Retaining walls require a site-specific design. Wall heights, requirements for drainage, and suitable materials must be determined through on-site inspections. Listed in this fact sheet are some suggestions of appropriate applications of retaining walls for erosion control. All types of retaining walls should conform to local building codes and ordinances. Plans and specifications should be prepared by professional engineers for most installations, including all that fall outside the parameters listed under the physical limits.

CONSTRUCTION GUIDELINES

Concrete retaining walls: Construct as designed by a professional engineer or as shown on the plans.

Masonry retaining walls: Construct as designed by a professional engineer or as shown on the plans.

Native rock retaining walls:

- Remove all large rocks from the eroding slope face and stockpile on site.
- Excavate a footing trench along the toe of the slope.
- Place the largest rocks in the footing trench with their longitudinal axis normal to the embankment face. Arrange subsequent rock layers so that each rock above the foundation course has a three-point bearing on the underlying rocks.
- The slope of the wall should be between 1/2:1 and vertical, depending upon the height of the wall, the height of the slope, the width of the right-of-way, or other limitations on space.
- Obtain fill material from the slope and place it behind the rock wall. Slope above the wall should be maintained at 2:1 or less with a slope bench at the toe. Backfill the footing trench with excavated material.
- If a roadway is located at the toe of the wall, pave the roadway up to the base of the rock wall and provide roadway curb for water transport. If a

roadway is not located at the toe of the retaining wall, slope the backfilled material away from the wall at 2 percent and stabilize it.

- Revegetate the stabilized slope immediately with a method applicable to the particular site. (See Sections 4.5 and 5.2 of this manual.)

Redwood (wood planking) retaining wall:

- Prepare the site by rough grading the slope surface, then work from the bottom of the slope towards the top.
- Set the bottom course of redwood posts into rigid base foundation material and secure with a concrete collar.
- Install planking on the upslope side of the posts. Provide sufficient vertical spacing to allow drainage at the base of the wall and between planks.
- Backfill behind the wall with material from the slope above. Slope the backfill material between redwood walls at 2 percent toward the top of the lower wall.
- Proceed in a similar fashion up the slope to the desired height.
- Revegetate the backfilled benches behind the walls according to procedures applicable to the specific site (see Sections 4.5 and 5.2 of this manual).

Railroad tie retaining wall:

- Prepare the site by rough grading the slope surface, then work from the bottom of the slope toward the top.
- Set the bottom course of railroad ties onto a rigid base foundation material and secure with pinning or metal collars.
- Backfill behind the wall with material from the slope above. Slope the backfill material between the tiers of railroad ties at 2 percent toward the top of the lower wall. If the engineered wall requires deadmen, install in accordance with the design drawing.
- Proceed in a similar fashion up the slope to the desired height. If the total height exceeds 2 meters, the wall must be designed and approved by a registered engineer.
- Revegetate the backfilled benches behind the walls according to procedures applicable to the specific site (see Sections 4.5 and 5.2 of this manual).

MSE retaining wall:

- Prepare the site and construct as shown on the plans.

MAINTENANCE

Retaining walls must be inspected periodically on regular intervals to detect signs of structural failure, and to check for damage caused by subsurface drainage or

material sloughing. In stream bank installations, inspect for signs of undercutting and other instability. Make all repairs promptly, as needed.